

The opinion in support of the decision being entered today was *not* written  
for publication and is *not* binding precedent of the Board

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* STEVEN JOEL BULLIED, JOHN JOSEPH MARCIN, JR.,  
ROBERT CHARLES RENAUD, ROY ALAN GARRISON, and STEPHEN  
DOUGLAS MURRAY<sup>1</sup>

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Appeal 2007-1488  
Application 10/809,072  
Technology Center 1700

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Decided: July 10, 2007

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Before ADRIENE LEPIANE HANLON, ROMULO H. DELMENDO, and  
SALLY G. LANE, *Administrative Patent Judges*.

DELMENDO, *Administrative Patent Judge*.

DECISION ON APPEAL

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<sup>1</sup> The real party in interest is UNITED TECHNOLOGIES CORP. (Appeal Br. 1).

1 STATEMENT OF THE CASE

2 Applicants appeal under 35 U.S.C. § 134(a) (2006) from a rejection of  
3 claims 1-12, 15, 17-30, and 33-35, which are all the claims pending in the  
4 subject application. (Appeal Brief received October 26, 2006.) We have  
5 jurisdiction under 35 U.S.C. § 6(b) (2006).

6 Applicants state that they have invented “systems for producing high  
7 performance single crystal investment cast components,” which “may allow  
8 a production yield of at least 50% or greater to be achieved therefrom.”  
9 (Specification 3, ¶[0007].) In the Background of the Invention, Applicants  
10 describe investment casting, which is prior art, as follows (Specification,  
11 ¶[0002]):

12 Investment casting has been used for many years to  
13 create near-net shape components that require minimal further  
14 machining after casting. Investment casting allows complex  
15 parts with intricate internal passages to be created. Generally,  
16 in the investment casting process, an injection molded wax  
17 pattern of a part is produced. The wax pattern may contain  
18 ceramic or refractory cores therein for creating the intricate  
19 internal passages in the finished component. Once formed, the  
20 wax pattern is encased in several layers of ceramic material to  
21 form a ceramic shell mold of the part. The wax is then removed  
22 from the ceramic shell mold via heating, and the ceramic shell  
23 mold is then fired and sintered in an oven. Thereafter, molten  
24 metal is poured into the ceramic shell mold, filling the cavities  
25 therein created by the evacuated or “lost” wax. The molten  
26 metal may then be selectively cooled to produce a final cast  
27 component having a desired controlled grain structure.  
28 Thereafter, the ceramic shell mold is removed, and the cast  
29 component can be heat treated, if desired, to strengthen the  
30 component and homogenize the metallurgical structure thereof.

31

1 Representative claim 1 reads as follows:

- 2       1. A system comprising:  
3           an investment molding cavity;  
4           a seed crystal starter cavity;  
5           a seed crystal for initiating epitaxial crystal growth in  
6           molten metallic material that comes into contact therewith;  
7           a grain selector operatively connecting the seed crystal  
8           starter cavity and the investment molding cavity for at least one  
9           of: (1) selecting a single crystal from the seed crystal to grow  
10          into the molten metallic material during solidification, or (2)  
11          ensuring that a single crystal from the seed crystal continues to  
12          grow into the molten metallic material during solidification;  
13          and  
14           a grain selector support for at least partially supporting  
15           the weight of the investment molding cavity and any molten  
16           metallic material contained therein to take at least a portion of  
17           this weight off the grain selector,  
18           wherein the system is capable of producing a single  
19           crystal investment cast component, and wherein the grain  
20           selector comprises a non-linear tubular structure comprising at  
21           least one of: a helix, a three-dimensional bend, a staircase, and a  
22           zigzag.

23  
24       The Examiner rejected claims 1-12, 15, 17-30, and 33-35 under 35

25       U.S.C. § 103(a) on three separate grounds over various combinations of  
26       prior art references.<sup>2</sup> (Answer 3-4.)

27       The prior art relied upon by the Examiner in rejecting the claims on  
28       appeal is:

29	Burd	US 4,180,119	Dec. 25, 1979
30	Giamei	US 4,475,582	Oct. 9, 1984

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<sup>2</sup> The Examiner expressly stated that the rejections no longer rely on United States Patent 4,940,073 issued to Jeyarajan et al., which had been applied in the Final Office Action of May 26, 2006. (Answer 3.)

23 Applicants, on the other hand, contend that Monte ‘468 and Monte  
24 ‘469 limit the configuration of the crystal (grain) selector to “simple single  
25 two-dimensional bends” and therefore teach away from “more complex  
26 grain selector configurations” such as “a helix, a three-dimensional bend, a  
27 staircase, and a zigzag.” (Appeal Br. 7-8 and 9-10.) Applicants further

1 contend that “[t]here is no suggestion or motivation” in the prior art  
2 references “to modify any of the inventions [described in the references] as  
3 suggested by the Examiner.” (Appeal Br. 11.)

4 We affirm all three rejections.

5

6 **ISSUE**

7 Have Applicants shown that the Examiner erred in concluding that  
8 one of ordinary skill in the art would have found it obvious to modify the  
9 system of Monte ‘468 or Monte ‘469 to include a helical crystal (grain)  
10 selector such as that shown in Burd, thus arriving at a system encompassed  
11 by appealed claim 1?

12 Have Applicants shown that the Examiner erred in concluding that  
13 one of ordinary skill in the art would have found it obvious to modify the  
14 system of Burd to include a seed crystal as taught in Monte ‘468 or Monte  
15 ‘469, thus arriving at a system encompassed by appealed claim 1?

16 Have Applicants shown that the Examiner erred in concluding that  
17 one of ordinary skill in the art would have found it obvious to modify the  
18 system of Giamei to include a grain selector support as shown in Monte  
19 ‘468, Monte ‘469, or Burd, thus arriving at a system encompassed by  
20 appealed claim 1?

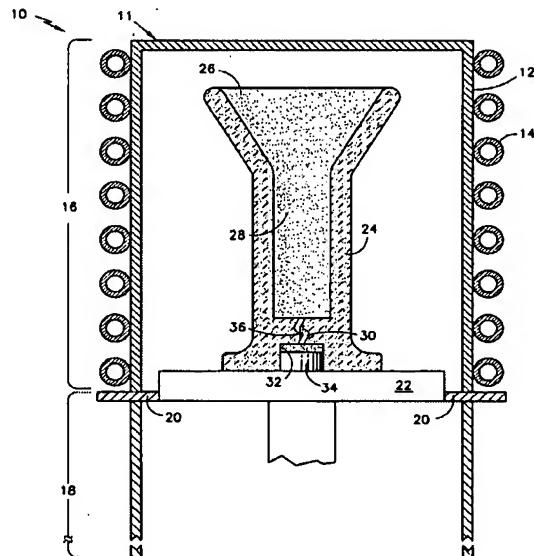
21

22 **FINDINGS OF FACT**

23 1. Applicants’ Specification states that Figure 1 shows “an  
24 exemplary investment casting system 10.” (Specification,  
25 [0022].)

26 2. Applicants’ Figure 1 is reproduced below:

FIG. 1



1

- 2       3. Applicants' Figure 1 is said to depict an investment casting  
3       system 10, wherein relevant reference numerals 28, 30, 32, 34,  
4       and 36 denote a mold cavity, a grain selector, a seed crystal  
5       starter cavity, a seed crystal, and a grain selector support,  
6       respectively. (Specification, [0023].)

7

8       *Rejection I: Monte '468 or Monte '469, Each in View of Burd*

- 9       4. The Examiner found that each of Monte '468 and Monte '469  
10      describes the claimed invention "except that the configuration  
11      of their grain selector is different from that...claimed." (Answer  
12      3.)
- 13      5. Applicants do not contest the Examiner's finding in this regard.
- 14      6. Specifically, the crystal (grain) selector described in Monte  
15      '468 or Monte '469 does not include "a non-linear tubular

- 1                   structure comprising at least one of: a helix, a three-dimensional  
2                   bend, a staircase, and a zigzag,” as recited in appealed claim 1.  
3                   7. The Examiner also found that both Monte ‘468 and Monte ‘469  
4                   teach that helical crystal (grain) selectors of the so-called  
5                   “pigtail” type have been used in the prior art but that they are  
6                   “relatively expensive,” which “may be contributed to by a  
7                   substantial scrap rate.” (Monte ‘468, 1:21-25; Monte ‘469,  
8                   1:17-22.)  
9                   8. The crystal (grain) selectors of Monte ‘468 and Monte ‘469 are  
10                  said to be an improvement over prior art grain selectors.  
11                  (Monte ‘468, 3:48-60; Monte ‘469, 2:25-36.)  
12                  9. The Examiner also relied on Burd to show that grain selectors  
13                  with a helical configuration were commonly used in the prior  
14                  art. (Answer 3; Burd, 2:10-35.)  
15                  10. Applicants do not rely on any evidence (e.g., declaration  
16                  evidence) to show that their invention does not suffer from the  
17                  known disadvantages of helical grain selectors.

18

19                  *Rejection II: Burd in View of Either Monte ‘468 or Monte ‘469*

- 20                  11. Burd’s Figure 2 is reproduced as follows:

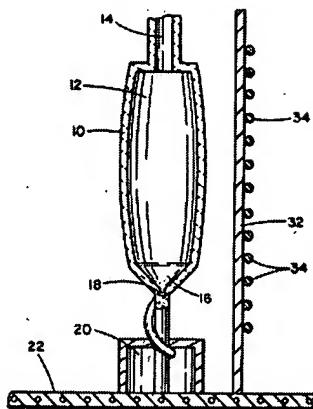


FIG. 2

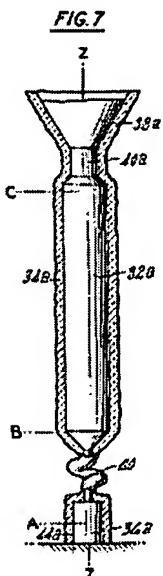
- 1
- 2      12. Burd's Figure 2 is said to depict a mold assembly, wherein
- 3                  relevant reference numerals 12, 18, and 20 represent a cavity, a
- 4                  helix crystal selector, and a starter chamber, respectively.
- 5                  (Burd, 2:3-48.)
- 6      13. The Examiner found that Burd describes every element of the
- 7                  claimed invention except it does not explicitly disclose "a seed
- 8                  crystal for initiating epitaxial crystal growth in molten metallic
- 9                  material..." as recited in appealed claim 1. (Answer 4.)
- 10     14. Applicants do not dispute the Examiner's finding in this regard.
- 11     15. Monte '468 teaches that a single crystal seed may be used in
- 12                  association with the crystal (grain) selector to provide an "even
- 13                  closer correspondence between the secondary orientation of the
- 14                  cast articles and the selected secondary orientation." (Monte
- 15                  '468, 22:18-23.)
- 16     16. Likewise, Monte '469 teaches that seed crystal may be used in
- 17                  combination with the crystal (grain) selector "[t]o enable only
- 18                  the main crystal having the desired crystallographic orientation

1                   to grow from the starter cavity to the article mold cavity.”

2                   (Monte ‘469, 2:57-60.)

4                   *Rejection III: Giamei in View of Monte ‘468, Monte ‘469, or Burd*

5                 17. Giamei’s Figure 7 is reproduced below:



18. Giamei’s Figure 7 is said to depict a ceramic shell mold, wherein relevant reference numerals 34a, 36a, 44a, and 60 represent a mold, a first seed, a starter section, and a helical selector, respectively. (Giamei, 5:27-44, 6:9-14.)
19. The Examiner found that Giamei describes every limitation of appealed claim 1 “except [Giamei does not disclose] the [use of a] grain selector support.”
20. Applicants do not contest the Examiner’s finding in this regard.
21. Monte ‘468 and Monte ‘469 both teach the use of a support element for the single crystal selector to support a bend section

1                   of the crystal selector against vertical and/or sideward loading.  
2                   (Monte '468, 6:43-48; Monte '469, 6:3-8.)

3       22. Similarly, Burd teaches the use of central column 26 "in the  
4                   form of a post high strength so as to be able to assume the load  
5                   otherwise imposed on the crystal selector." (Burd, 2:41-44;  
6                   Figures 1-2.)  
7

## 8                   PRINCIPLES OF LAW

9       The factual inquiry into whether claimed subject matter would have  
10      been obvious includes a determination of: (1) the scope and content of the  
11      prior art; (2) the differences between the claimed subject matter and the prior  
12      art; (3) the level of ordinary skill in the art; and (4) secondary considerations  
13      (e.g., the problem solved) that may be indicia of (non)obviousness. *Graham*  
14     *v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966). The Supreme  
15      Court of the United States has stated that "[t]he obviousness analysis cannot  
16      be confined by a formalistic conception of the words teaching, suggestion,  
17      and motivation, or by overemphasis on the importance of published articles  
18      and the explicit content of issued patents." *KSR Int'l Co. v. Teleflex, Inc.*,  
19     127 S. Ct. 1727, 1741, 82 USPQ2d 1385, 1396, (2007). Rather, "[w]hen  
20      there is a design need or market pressure to solve a problem and there are a  
21      finite number of identified, predictable solutions, a person of ordinary skill  
22      has good reason to pursue the known options within his or her technical  
23      grasp." *KSR*, 127 S. Ct. at 1732, 82 USPQ2d at 1397.

24       "When the PTO shows prima facie obviousness, the burden then shifts  
25      to the applicant[s] to rebut." *In re Mayne*, 104 F.3d 1339, 1342, 41 USPQ2d  
26      1451, 1454 (Fed. Cir. 1997). "Such rebuttal or argument can consist of a

1 comparison of test data showing that the claimed compositions possess  
2 unexpectedly improved properties or properties that the prior art does not  
3 have...” *In re Dillon*, 919 F.2d 688, 692-93, 16 USPQ2d 1897, 1901 (Fed.  
4 Cir. 1990)(en banc).

5

6 ANALYSIS

7 Applicants have argued claims 1-12, 15, 17-30, and 33-35 together.  
8 We therefore select claim 1 as representative of all the appealed claims and  
9 confine our discussion to this representative claim. Furthermore, any  
10 argument not made has been waived. 37 CFR § 41.37(c)(vii).

11

12 *Rejection I: Monte ‘468 or Monte ‘469, Each in View of Burd*

13 The Examiner found that the only difference between the invention  
14 recited in appealed claim 1 and the system of Monte ‘468 or Monte ‘469 is  
15 in the configuration of the tubular structure of the grain selector. This  
16 finding is not disputed. The Examiner then demonstrated that helical grain  
17 selectors were old in the art and thus concluded that it would have been  
18 obvious to one of ordinary skill in the art to modify Monte ‘468 or Monte  
19 ‘469 by providing the systems described therein with a conventional helical  
20 grain selector.

21 Applicants argue, however, that each of the Monte references  
22 describes the use of an improved crystal selector having a single bend  
23 section and “actually teaches away from the more complex grain selector  
24 configurations (i.e., helix, three-dimensional bends, staircases, zigzags) of  
25 the present invention...” (Br. 7.) We disagree.

1       Here, rather than teach away, Monte '468, Monte '469, and Burd all  
2 indicate to one of ordinary skill in the art that helical grain selectors were  
3 well known in the art and have been successfully used. *In re Fulton*, 391  
4 F.3d 1195, 1201, 73 USPQ2d 1141, 1146 (Fed. Cir. 2004) ("[M]ere  
5 disclosure of alternative designs does not teach away."). That the Monte  
6 references state that helical grain selectors result in certain disadvantages,  
7 such as higher cost, does not automatically render a claim reciting such  
8 helical grain selectors patentable. Specifically, Applicants have not shown  
9 that their claimed invention does not suffer from the same disadvantages. A  
10 reference "teaches away" if a person of ordinary skill in the art would have  
11 been discouraged or led to a divergent path from the one taken by the  
12 inventors. *In re Gurley*, 27 F.3d 551, 553, 31 USPQ2d 1130, 1132 (Fed.  
13 Cir. 1994) ("Although a reference that teaches away is a significant factor to  
14 be considered in determining unobviousness, the nature of the teaching is  
15 highly relevant, and must be weighed in substance. A known or obvious  
16 composition does not become patentable simply because it has been  
17 described as somewhat inferior to some other product for the same use.").  
18

19           *Rejection II: Burd in View of Either Monte '468 or Monte '469*

20       The Examiner found that the only difference between the invention  
21 recited in appealed claim 1 and the system of Burd lies in the use of a seed  
22 crystal. This finding is not disputed. The Examiner then found that the  
23 Monte references teach the use of a single crystal seed in combination with a  
24 non-linear tubular grain selector to ensure that a predetermined crystal  
25 structure is obtained in the final cast component. Based on these findings,  
26 the Examiner concluded that it would have been obvious to one of ordinary

1 skill in the art to modify Burd's system with a seed crystal as shown in  
2 Monte '468 or Monte '469 in order to ensure the growth of only a single  
3 crystal, thereby reducing the scrap rate.

4 Applicants argue that "Burd never even mentions the possibility of  
5 using a seed crystal." (Br. 8.) This argument is unpersuasive. The  
6 Examiner acknowledged this difference but relied on the Monte references  
7 to account for the difference. Applicants' argument ignores the collective  
8 teachings of the prior art as the evidentiary basis for the Examiner's  
9 rejection. *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA  
10 1981) ("The test for obviousness is not whether the features of a secondary  
11 reference may be bodily incorporated into the structure of the primary  
12 reference; nor is it that the claimed invention must be expressly suggested in  
13 any one or all of the references. Rather, the test is what the combined  
14 teachings of the references would have suggested to those of ordinary skill  
15 in the art.").

16 Applicants appear to be urging an incorrect standard of obviousness  
17 ("lack of suggestion in the prior art of the desirability of combining  
18 references"). (Br. 11; *see also* R. Br. 2-3.) The Supreme Court has recently  
19 disapproved such a rigid approach to obviousness. *KSR*, 127 S. Ct. at 1741.  
20 Here, seed crystals have been used in the prior art in similar systems, as  
21 shown in the Monte references. Thus, a person having ordinary skill in the  
22 art would have reasonably predicted that the use of a seed crystal in Burd  
23 would provide similar advantages and results as reported in the Monte  
24 references. Applicants have not shown anything beyond what would have  
25 been expected by a person skilled in the art.

26

1           *Rejection III: Giamei in View of Monte ‘468, Monte ‘469, or Burd*

2           The Examiner found that the only difference between the invention  
3           recited in appealed claim 1 and the system of Giamei lies in the use of a  
4           grain selector support. This finding is not disputed. The Examiner then  
5           found that the Monte references and Burd all teach the use of a selector  
6           support to assume the load. Based on these findings, the Examiner  
7           concluded that it would have been obvious to one of ordinary skill in the art  
8           to modify Giamei’s system with a selector support as shown in Monte ‘468,  
9           Monte ‘469, or Burd in order to lessen the load on the crystal selector.

10          Applicants’ only contention appears to be that there is no motivation  
11          or suggestion to combine. (Br. 11; R. Br. 3-4.) Even if this were the only  
12          test that is appropriate for determining obviousness, we disagree. Monte  
13          ‘468, Monte ‘469, and Burd provide a reason for combining their teachings  
14          with those of Giamei, namely to ease the load on the crystal selector.

15

16           CONCLUSIONS OF LAW

17          On the record before us, Applicants have failed to rebut the *prima  
18 facie* case established by the Examiner that a person of ordinary skill in the  
19 art would have found the subject matter of appealed claims 1-12, 15, 17-30,  
20 and 33-35 obvious over the prior art.

21          We therefore affirm the rejections under 35 U.S.C. § 103(a) of all  
22 appealed claims.

23  
24  
25  
26

Appeal 2007-1488  
Application 10/809,072

- 1        No time period for taking any subsequent action in connection with
- 2        this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED

LP

PRATT & WHITNEY  
400 MAIN STREET  
MAIL STOP: 132-13  
EAST HARTFORD CT 06108